

Article

Assessing the EU Energy Efficiency Label for Appliances: Issues, Potential Improvements and Challenges

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Abstract: The EU Energy Efficiency (EE) label for appliances, readjusted in March 2021 (Directive 2017/1369/EU), is a key instrument for nudging consumers towards more energy-efficient purchases. However, its effectiveness depends on its design, the information provided and consumers' understanding of and trust in it. This paper seeks to contribute to the assessment of the EE label for appliances and to identify issues, potential improvements and challenges for successfully nudging consumers towards highly energy-efficient choices. To that end, 33 in-depth interviews have been conducted with three different groups (citizens, appliance retailers and experts in energy) to ascertain the opinions and experiences of different agents as to consumers' preferences and opinions on EE and energy consumption. We focus on purchasing decision-making by Spanish consumers for the three main appliances: washing machines, fridges and dishwashers. The EE label for appliances seems to be well-known and reliable for consumers. The main weakness lies in people's understanding of its content rather than in its design. The coloured alphabetical EE scale seems to be well understood and the restored A–G scale of the readjusted label positively valued. However, we find comprehension issues with regard to the information on energy consumption and the technical data at the bottom of the label. Monetary information on energy consumption seems to facilitate consumers' understanding, but it is technically challenging due to the complexity of the unit of measurement. Results are discussed, taking into account the relevant literature.

Keywords: energy efficiency; energy label; energy consumption; purchasing decision-making; appliances; in-depth interviews



Citation: de Ayala, A.; Solà, M.d.M. Assessing the EU Energy Efficiency Label for Appliances: Issues, Potential Improvements and Challenges. *Energies* **2022**, *15*, 4272. <https://doi.org/10.3390/en15124272>

Academic Editors: Luis Maria Abadie and Ibon Galarraga

Received: 9 May 2022
Accepted: 7 June 2022
Published: 10 June 2022

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1. Introduction

Energy efficiency (EE), defined as improvements in the efficiency with which energy is used to provide a service, has become crucial in recent years for achieving the EU target of 32.5% energy savings by 2030 (Energy Efficiency Directive 2018/2002). EE has several strengths and benefits, but these are not usually enough to encourage consumers to make the most energy-efficient choices. Although EE seems to be financially profitable for consumers, they do not usually invest as much as may seem rational [1–3]. This is known as the *energy efficiency gap*.

The EE gap can be explained by failures of several types, including behavioural failures, informational failures and other market failures [3–5]. Informational failures are one of the most common types: they involve situations in which consumers lack or misunderstand the information needed to make optimal choices. There are various policy instruments for coping with such failures: energy certificates and labels, information feedback tools and energy audits [4–6]. EE labels are one of the easiest and cheapest ways to successfully nudge consumers towards more energy-efficient choices [4,5]. This is particularly important for household appliances, which account for 25.6% of the total energy consumption of Spanish households [7].

A new European directive on EE labels came into force in March 2021 for household appliances (Directive 2017/1369/EU). It requires EE labels to be displayed on energy-related appliances at the point of sale with a scale from A to G, in different colours (green for highly energy-efficient appliances and red for less efficient ones). This original energy scale was reintroduced via a new regulation passed in January 2017 in the light of evidence that the A+++–D scale was not effective [8]. The main changes in this new directive compared to the previous one (Directive 2010/30/EU) are: (i) the scale of EE labels now ranges from A–G instead of A+++–D; (ii) energy consumption information for washing machines and dishwashers now appears in terms of use instead of per year; and (iii) the interface of the icons at the bottom of the label is different (see Figure 1).

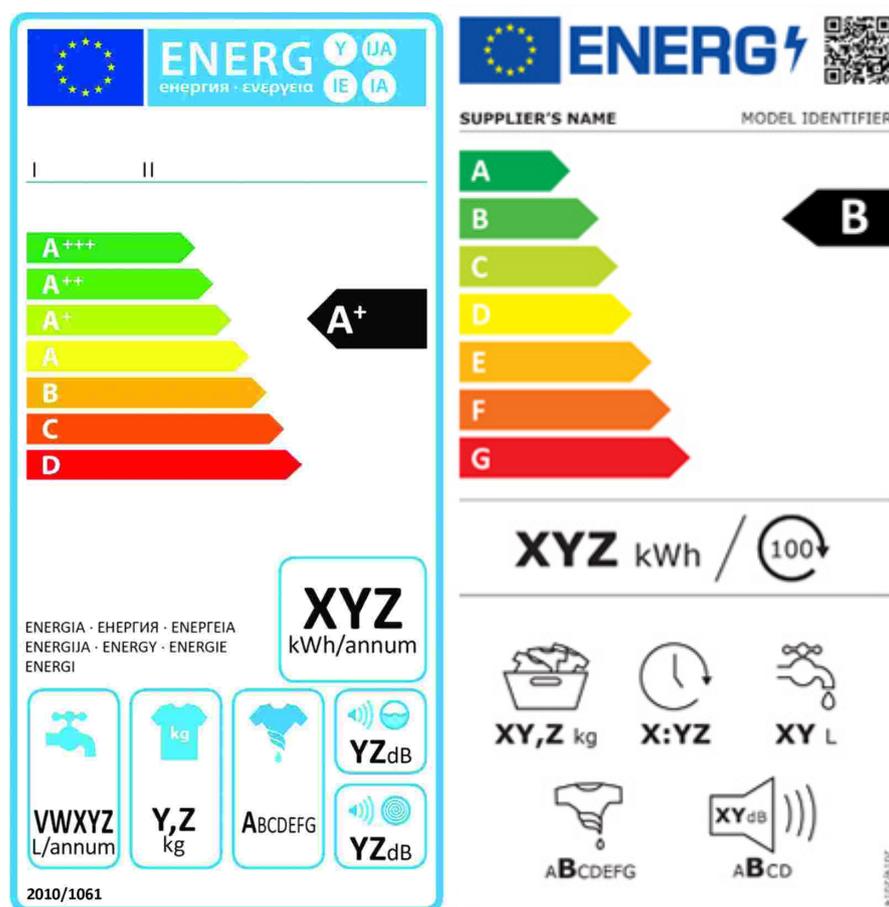


Figure 1. The old energy efficiency label (A+++–D scale) (Directive 2010/30/EU) and the new energy efficiency label (A–G scale) for washing machines, which entered into force in March 2021 (Directive 2017/1369/EU).

This paper seeks to contribute to the assessment of the EE label for appliances and to identify issues, potential improvements and challenges for successfully nudging consumers towards highly energy-efficient purchases through the EE label. This is done in various steps. First, we seek to understand the role of EE in consumers' decision-making on the purchase of appliances. Second, we assess how widely accepted the EE label is among consumers (whether they recognise it, understand it, trust it and take it into account). This includes an evaluation of the readjusted EE label. Finally, we look for possible improvements in the way in which energy consumption information is presented, and in particular, whether monetary information on energy consumption can be included on the label.

This all will be analysed from three different perspectives to ascertain the opinions and experiences of different agents related in different ways to energy consumption and

EE: (i) that of the public as users of household appliances; (ii) that of household appliance retailers as experts in purchasing decision-making by customers; and (iii) that of academic experts as specialists in the field of energy research. The public is expected to answer the questions based on their own behaviour and reactions, while sellers and experts should provide insights into the consumer tendencies and habits based on their experience and specialist knowledge. This enables us to reflect on the acceptability of the previous and restored EE labels and to make recommendations for the design of an effective label to encourage consumers to purchase highly energy-efficient appliances.

There is previous research assessing the EE label in general [9,10] and focusing on particular aspects of it such as the design of the EE scale [10–12] how energy information is presented [13–15] and how it is understood, perceived and considered [16,17]. The relevant literature has tested the effectiveness of presenting energy consumption information as monetary information [14,18,19] or health-related information [20]. In the appliances market, there are recent studies that measure the effect of providing monetary information in terms of energy cost [14,19,21,22] or as energy savings [15] as a way of promoting EE.

Previous assessments of the EE label provide mainly quantitative evidence and may lack a clearly thought-out explanation of the motivations behind each preference and choice. As pointed out by Bavaresco et al. [23], energy research may still lack social science approaches to improve its outcomes and assess the human dimension of energy use. In Spain, an earlier study [16] explores the factors that motivate consumers to purchase energy-efficient goods across different sectors (households, the accommodation sector and private service companies) and products (appliances, heating, ventilation and air-conditioning and cars). The present study focuses mainly on identifying issues, potential improvements and challenges in the EE label for appliances from three different viewpoints (the general public, retailers and experts in energy research) to provide guidance for effective EE labels. It also provides a comparison between the readjusted label (in use from March 2021) and the previous one.

Qualitative analysis may give significant insights into these aspects from different standpoints since it provides a deeper understanding of how the EE label is understood, why (and why not) it is taken into account and how it can be improved. We use a number of in-depth interviews with members of the general public, retailers and experts in the field of energy research to ascertain their opinions, experiences, expectations and knowledge regarding consumer behaviour towards EE and EE labels. We focus on purchasing decision-making by Spanish consumers and on three main appliances—fridges, washing machines and dishwashers—as they account for 30.6%, 11.8% and 6.1% of energy consumption in Spanish households, respectively [7].

Section 2 looks at previous publications assessing the EU EE label and ways to improve it. Section 3 describes the methodology applied in this study. Section 4 presents our findings. Section 5 discusses them and concludes.

2. The Effectiveness of the EU Energy Efficiency Label for Appliances

Research into understanding consumer reactions to EE labels for vehicles and household appliances has been growing in recent years due to the mandatory implementation of EE labels in these markets and increasing energy and environmental concerns (see [5] for a review). In the appliances market, there is a growing body of research on estimating EE label price premiums, e.g., for washing machines, dishwashers and refrigerators in Spain [24–26]; for washing machines in Switzerland [27]; for washing machines, refrigerators and air conditioners in China [28–30]; and for refrigerators in Germany [31,32] and the US [33–35]. These studies estimate a positive willingness to pay for highly energy-efficient appliances, although its scale varies from country to country and in line with different consumer profiles, years of study and appliance types [29,36]).

Other studies focus on assessing EE labels and particularly on how their design and the information presented can affect their effectiveness and therefore decision-making by consumers. Table 1 presents a summary of studies assessing the EU label for appliances in

terms of label design and type (and format) of information. With regard to label design, Egan and Waide [9] compare energy labelling programmes in nine countries and highlight that labels which represent EE levels via discrete categories (stars, letters or numbers) are preferred over those that use a continuous scale.

Heinzle and Wüstenhagen [11] carried out a discrete choice experiment in Germany concerning the EE scale and concluded that German consumers are more willing to pay a higher premium for TVs with the highest ratings on the A–G scale than on the A+++–D scale. Waechter et al. [10] found that not only the letter range used in the scale but also the number of EE categories can influence consumers' choices. They tested the impact of a shorter EE scale with just 3 EE classes (A–C scale) for different appliances (freezers, lamps and coffee machines) in Switzerland and found that it increased the perceptions of EE gains in high-EE products, which could motivate consumers to choose the most energy-efficient products.

Waide et al. [37] used questionnaires, focus groups and in-depth interviews to analyse the understanding of consumers (from London, Prague and Paris) with regard to revised energy labels for appliances (fridge-freezers, washing machines, dishwashers and television sets) introduced at the end of 2011 (Directive 2010/30/EU). Their evidence shows that higher EE classes under the previous A–G scale implemented in 1995 are much more motivating for consumers than those under the A+++–D scale.

London Economics [12] assessed alternative EE label designs for different appliances (televisions, washing machines and light bulbs) in seven EU Member States by means of an online behavioural experiment and a bricks-and-mortar experiment. They found that consumers' understanding does not vary between A–G and A+++–D scales, but they found evidence that more consumers choose energy-efficient appliances when the A–G scale is used than under the A+++–D scale. The same study notes that the EE scale is better understood when it is represented by letters than by numbered frames. De Ayala et al. [16] also find that the coloured alphabetical grid is much appreciated in Spain.

There is a growing body of research assessing the energy-related information presented on labels and how to influence consumers' choices. De Ayala et al. [16] recognise various ways of facilitating consumers' understanding of energy consumption, such as using a scale to tell whether consumption is low or high and presenting monetary information on energy consumption. However, several issues can be identified with regard to measuring monetary information, such as the market price of energy and the reference used.

Various ways of providing monetary information are noted in the literature, in terms of energy cost or energy savings. For energy cost, Kallbekken et al. [18] used a field experiment to test the effectiveness of providing lifetime energy cost information on tumble dryers and freezers. They found no effect for freezers but a decrease in the average energy consumption of tumble dryers sold when labels provide monetary energy cost information and sales staff have training on EE-related issues. Similarly, using an online field experiment for washing machines, Deutsch [38] found a small but significant reduction in energy use when consumers receive additional information on life-cycle costs.

Bull [39] concludes that information on running costs and emissions increases willingness to pay and that lifetime running cost information is more effective than per annum information. Heinzle [40] conducted a discrete choice experiment and found that consumers will pay a higher price premium for televisions when ten-year monetary costs are displayed but a lower premium when one-year cost information is displayed (compared to non-monetary EE information). In line with these results, Blasch et al. [21] conducted a randomised control trial in Switzerland and showed that energy and investment literacy are positively correlated with the probability of choosing the fridge with the lowest lifetime energy cost.

Table 1. Summary of studies assessing EU labels for appliances.

Study	Concept Tested	Methodology	Appliance/s	Result
Heinzle and Wüstenhagen [11]	EE scale	Discrete choice experiment	Television	An A–G scale is more effective in guiding consumers' decisions towards energy-efficient products
Waechter et al. [10]	EE scale	Online experiments	Freezers, lamps, coffee machines	A shorter scale with 3 classes (A–C) increases consumers' motivation to choose the most energy-efficient products
Waide et al. [37]	EE scale	Questionnaires, focus groups and in-depth interviews	Fridge-freezers, washing machines, dishwashers, televisions	High EE classes are more motivating on an A–G scale than on an A+++–D scale
Design				
London Economics [12]	EE scale	Online behavioural experiment and bricks and mortar experiment	Televisions, washing machines and light bulbs	<ul style="list-style-type: none"> Labels with an A–G scale lead more consumers to choose energy-efficient products than an A+++–D scale Consumers understand alphabetical EE frameworks better than numerical ones
Egan and Waide [9]	EE scale	Market research	Appliances in general	Discrete EE categories (stars, letters or numbers) are more effective than a continuous scale
de Ayala et al. [16]	EE scale	Focus groups and in-depth interviews	Appliances, heating and cooling systems and cars	The coloured alphabetical scale is valued positively
de Ayala et al. [16]	Monetary information on energy consumption	Focus groups and in-depth interviews	Appliances, heating and cooling systems and cars	Monetary information is valued positively but there are issues in measuring it (energy price and frequency of use)
Kallbekken et al. [18]	Ten-year energy cost information	Field experiment	Tumble dryers and freezers	Ten-year energy cost information is effective for tumble dryers but no effect is found for freezers
Content				
Deutsch [38]	Life cycle cost information	Online field experiment	Washing machines	Life cycle cost information results in a reduction in energy use of 0.8%
Bull [39]	Running cost information (per year and lifetime) and emissions information	Stated preference survey	Washing machines	<ul style="list-style-type: none"> Running cost and emissions information increases willingness to pay for washing machines Lifetime running cost information is more effective than per annum information

Table 1. Cont.

	Study	Concept Tested	Methodology	Appliance/s	Result
Content	Heinzle [40]	Ten-year energy cost information vs. per annum information	Discrete choice experiment	Televisions	A higher price premium is found when ten-year cost information is presented and a lower one when per annum information is shown
	Blasch et al. [21]	Lifetime energy cost information	Randomised control experiment	Fridge	Energy and investment literacy is positively correlated with the probability of investing in high-efficiency fridges
	Solà et al. [41]	Lifetime (ten-year) energy cost information	Field experiment	Washing machines, fridges, dishwashers and tumble dryers	Lifetime energy cost information is effective in promoting the purchase of A+++ tumble dryers and A++ washing machines, fridges and dishwashers
	Allcott and Sweeney [42]	Energy cost information per year + sales staff	Natural field experiment	Water heater	Energy cost information and information provided by sales staff are effective when treated jointly
	Carroll et al. [43]	Five-year energy cost information	Field Experiment	Tumble dryers	No effect is found
	Skourtous et al. [19]	Annual operating cost	Discrete choice experiment	Fridge	No effect is found
	d'Adda et al. [22]	Yearly or lifetime energy cost	Field experiment	Fridge	<ul style="list-style-type: none"> • Energy cost information directs purchases towards cheaper products in lower EE classes, but with similar energy and total costs • There is a trade-off between economic savings and higher search costs
	Solà et al. [14]	Lifetime (ten-year) energy savings information	Field experiment	Washing machines, fridges and dishwashers	Lifetime energy savings information is useful for promoting the adoption of high-efficiency washing machines and fridges, but no effect is found for dishwashers
	Stadelmann and Schubert [15]	Lifetime monetary information (cost and/or savings)	Online field experiment	Freezers, tumble dryers, vacuum cleaners	Monetary information is useful in increasing the adoption of highly efficient tumble dryers and vacuum cleaners, but no effect is found for freezers

Source: Own work.

In a field experiment in Spain, Solà et al. [41] found that lifetime energy cost information is effective in promoting the adoption of high-efficiency tumble dryers (A+++) and of A++ labelled washing machines, fridges and dishwashers. A similar field experiment was run by Allcott and Sweeney [42], who showed that energy cost information per year and sales incentives need to be treated jointly to boost energy-efficient purchases. By contrast, a field experiment conducted by Carroll et al. [43] found that providing 5-year energy cost information has no effect on tumble dryers. Finally, Skourtos et al. [19] ran a choice-based experiment in Greece and found that including the annual operating cost of fridges has no effect on consumers' choices. They therefore proposed using energy savings campaigns to promote the purchase of high-efficiency appliances.

A recent study [22] involved a field experiment with an Italian online retailer for refrigerators purchases and found that: (i) adding yearly or lifetime energy cost information on the label shifts purchases from top-ranked to low EE classes with lower prices but similar overall energy and total costs, since the distributions of energy costs of different EE classes overlap; (ii) providing monetary information extends product searches among consumers, with more attention paid to low EE products. Given this, the authors call into question the effectiveness of providing running cost information on labels.

Concerning monetary information on energy savings, Solà et al. [14] conducted a field experiment to analyse the effectiveness of providing lifetime energy savings information for washing machines, fridges and dishwashers in Spain. They found that giving monetary information through a monetary label is effective in promoting high-efficiency washing machines, while both monetary information provided by staff alone and the combination of a monetary label and information from sales staff seem to be effective in promoting purchases of high energy-efficiency fridges. Stadelmann and Schubert [15] ran a field experiment to compare the effectiveness of labels in different scenarios (no label, EU energy label and lifetime-oriented monetary energy label) for freezers, tumble dryers and vacuum cleaners. The monetary label indicates lifetime energy savings or costs depending on the energy consumption of the product. They found that the presence of either label increases sales for high-efficiency tumble dryers and vacuum cleaners, but not for freezers.

The other (non-energy) information on the energy label has also been questioned in some studies such as de Ayala et al. [16] and Waide et al. [37]. They highlight that consumers find it hard to understand the technical information in the form of icons presented at the bottom of the label (e.g., noise level, capacity, spin efficiency class, water consumption) and that they do not even take this information into account in their purchasing decision-making.

3. Methodology

Data were collected via semi-structured guided interviews and in-depth interviews applied to three groups: members of the general public as users of household appliances, retailers experienced in purchasing decision-making by customers and experts in energy-related research. The interview method, the subsampling method, the topic guideline and the data analysis are outlined below.

3.1. In-Depth Interviews and Sample

An in-depth interview (IdI) is a pre-arranged, direct, personal interview in which a single participant is questioned by an experienced interviewer to talk in-depth about the topic under investigation and uncover underlying motivations, beliefs, attitudes and feelings on that topic. The main idea is to identify and understand the pattern of thoughts, emotions and behaviour of an individual participant.

IdIs are often referred to as semi-structured interviews because the researcher retains some control over the direction and content to be discussed, but participants are free to elaborate or take the interview in new but related directions [44]. IdIs are usually carried out face-to-face so that a rapport can be created with interviewees. The interview is conducted

using a discussion topic guide which helps to flush out the respondent's views through open-ended questioning [45–47].

The aim of the sampling design in IdIs and qualitative research, in general, is to gather enough data to give an accurate understanding of the topics under investigation and the different views that are present in the study population. Furthermore, the sample tends to be constructed “purposively” rather than drawn randomly from a sample frame. Purposive sampling (also known as targeted or judgement sampling) covers a wide variety of characteristics referring to the construction of the sample in some way that facilitates the satisfaction of the research questions [46,48]. A typical IdI in social sciences uses a target sample of between 10 and 50 interviews [48].

In total, 33 IdIs were conducted in Spain between April and May 2021 to assess the role of EE and EE labels in purchasing decision-making by consumers for appliances from the perspectives of different participants: 11 for members of the public, 10 for retailers and 12 for experts.

The IdIs for the public and for retailers were carried out face-to-face by a survey company (CPS) (<https://www.cps2000.com>, accessed on 1 November 2021) and lasted about 30 min each. The members of the public and retailers interviewed were from the city of Bilbao and other municipalities in the province of Bizkaia (Spain). They were paid (€10) to encourage their active participation. We ourselves conducted the IdIs for experts online, as they came from different parts of Spain. They also lasted about 30 min.

The members of the public comprised 11 homeowners who had bought a new appliance (washing machine, fridge or dishwasher) in the last 5 years. Five of them had also benefited from Spain's *RENOVE* household electrical appliance renewal programme in any of their purchases, so we were able to look at the effect of this programme on their purchasing decision-making. The *RENOVE* programme is promoted by the Spanish Institute for Energy Diversification and Saving (IDAE). Through it, each regional autonomous community offers users financial incentives to replace old appliances with new, more efficient ones (i.e., with the highest EE level).

The 11 individuals selected were recruited strategically to ensure heterogeneity regarding gender, age, education level, household composition, employment situation and household income level. The recruitment criteria for the sample of the members of the public can be seen in Table A1 of Appendix A.

The sample of retailers consisted of 10 individuals selected in order to ensure that household retail appliance-selling establishments of different types and with differing turnovers in the province of Bizkaia (small, medium and large) were represented (see Table A2 of Appendix A).

The sample of experts comprised 12 Spanish academics from different research centres and universities, covering various areas of expertise in the field of energy (energy and climate change policies, energy modelling, energy markets and EE) while ensuring gender balance (see Table A3 of Appendix A). Experts were contacted via email to explain the study and its objective. Then, an appointment was made for the online interview.

The reason for choosing strategic recruitment criteria rather than trying to aim for better statistical representativeness is that the objective of our study is to understand the motivations, experiences and type of arguments behind each question, rather than to measure preferences quantitatively (which can be done better by conducting a survey). We selected participants who we expected to have different experiences and perspectives (e.g., households with children versus households without children, retailers from large establishments versus retailers from small establishments or experts in the field of EE versus experts in other energy-related topics), and who we thus expected to have different opinions on EE and EE labels for appliances. Targeted sampling is a common sampling strategy in qualitative research [16,17,49,50].

3.2. Topic Guideline and Data Analysis

For all three groups, the interviews were semi-structured with open-ended questions, allowing for discussion with the interviewee rather than following a straightforward question-and-answer format. The IdIs followed a detailed topic guide with a list of questions to make sure that the pre-defined list of topics was covered [45–47].

A general common guideline for all three groups was prepared to allow comparison between their perspectives regarding the various topics, but questions were tailored to each particular group by rephrasing them or adding further points in accordance with the target audience.

The general common guide comprises 5 sections. The first section (“Appliances”) seeks to identify the main appliances in Spanish households and the second (“Purchasing decision-making”) seeks mainly to identify the key attributes that influence purchasing decision-making by consumers for appliances (e.g., “What are the key factors that consumers take into account when buying a new appliance?”, “Do consumers take EE labels into account when buying a new appliance?”).

The third section (“Energy efficiency and energy consumption”) asks what consumers understand by EE, what consumers can do to reduce the energy consumption of appliances (in IdIs for the public and experts only) and what the general buyer profile is (gender, age, household composition, household income level, education level, etc.) for high-efficiency appliances (in IdIs for retailers and experts only). In this section, experts are also asked to reflect on the effectiveness of intervening in the purchase decision versus in decisions on energy use (“Which do you think can be more effective in promoting energy savings: intervening in the purchase decision and/or intervening in the energy use? Why?”).

The fourth section (“Energy efficiency label for appliances”) assesses the acceptability of the EU EE label for appliances: whether consumers are familiar with it, understand it, use it and trust it. This includes the assessment of the readjusted EE label in use since March 2021. The fifth section (“Possible changes”) covers potential improvements in the EE label for appliances so as to promote EE (“Do you think there is room for improvement in the EE label? What? How? Why?”). We asked particularly about the possibility of providing monetary information on the energy consumption of appliances (“Do you think it would be useful to have visible monetary information on the energy consumption of the appliance (in euros rather than kWh) when buying? Why?”) and about the terms (cost or savings in euros) and units (per year, per month, per use, lifetime, etc.) in which that monetary information should be shown. Finally, we also asked about other potential ways to effectively inform about the energy consumption and EE of appliances (“Do you think there is any other way to inform about the energy consumption and efficiency of appliances apart from the current energy efficiency label? Which one? Why?”).

The IdIs for retailers had an extra section focusing on the role of sales staff in purchasing decision-making by consumers (what type of information consumers usually request, what they think is the most effective way to inform customers about EE, etc.) and the effect of Spain’s *RENOVE* subsidy programme for appliance renewal on their sales.

It is important to highlight that members of the public answered questions with regard to their own behaviour and opinions towards EE, but retailers and experts had to answer thinking of how consumers or customers behave in this regard based on their experience and specialist knowledge. The complete detailed topic guide, including the full list of questions asked and an indication of to whom each question was addressed, can be found in Appendix B.

All IdIs were digitally recorded and transcribed to text. Content analysis was used to systematically transform this large amount of text into a highly organised, concise summary of key results [45,51]. A table was created following the topic guideline to include all comparable information in the same structure. Each column in the table refers to a single interviewee, while each row shows the information on a specific question. The information collected was assessed on a macro level in search of similar patterns, concepts and general themes [52,53].

4. Results

4.1. Purchasing Decision-Making for Appliances

4.1.1. What Consumers Understand by EE and Its Role in Their Purchasing Decision-Making

The public seems to find the idea of EE quite complex: they associate it with several concepts. As can be seen in Figure 2, experts (asked about consumers) and the public both relate EE to a reduction in energy consumption, to potential energy savings in monetary terms and to the performance of appliances in general. Energy bills were mentioned only by the public, and environmental impacts were mentioned only by experts.

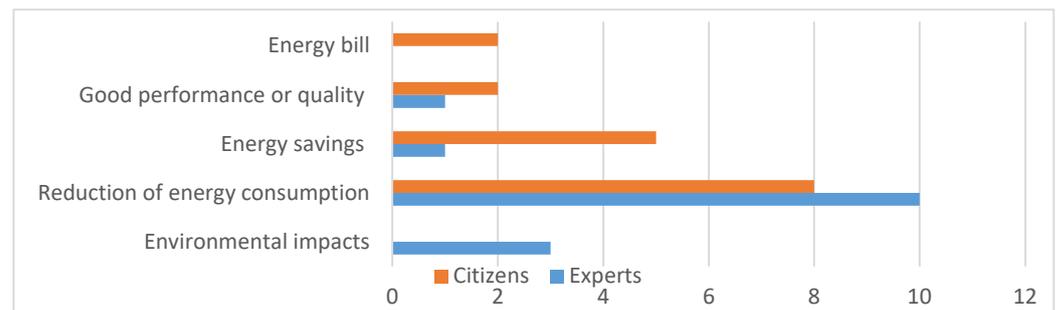


Figure 2. Concepts related to EE according to members of the public and experts.

EE does not seem to be a key attribute in purchasing decision-making for appliances. Only four members of the public mentioned it as an important factor in purchasing decisions for washing machines, three for fridges and four for dishwashers. All three types of interviewees placed price, capacity and dimensions, brand and certain technical factors (rpm, ease of use and short duration programmes for washing machines; distribution of drawers and no-frost option for fridges) ahead of EE when purchasing a washing machine, a fridge or a dishwasher (see Table A4 of Appendix C).

4.1.2. The Profile of Consumers Who Invest in EE

According to the experts, the profile of consumers who invest in EE depends on disposable income, age, education level and, to a lesser extent, the household composition and the climate zone where they live. Disposable income is seen as a budget constraint when buying an appliance. The experts believe that younger people and consumers with a medium-to-high education level tend to invest more in EE because they are more environmentally aware and can more easily calculate the payback period on the investment. However, one of the experts highlighted that education level does not necessarily have to be very high, since environmental awareness is quite widespread nowadays. To a lesser extent, families with children and those who live in cold climate zones are seen as significant due to their higher energy expenditure. One expert also mentioned ideology as a potentially influential factor (Expert 5: “Households with a more progressive ideology are more aware because they are less aligned with climate change deniers”).

4.1.3. Where Do Consumers Get Their Information on EE?

All three groups interviewed (members of the public, retailers and experts) agreed that consumers obtain their information on EE mainly from the EE label, supplemented by Internet searches prior to purchase and explanations from sales staff at the time of purchase. Indeed, a significant proportion of retailers and experts stated that the Internet tends to be used particularly by young people or those who are more environmentally aware, while elderly people seek advice in the store from the retailer. These findings are supported by the interviews with members of the public: those who stated that they used the internet were the youngest interviewees in the sample (aged 29, 38, 39 and 40), while those who said that they mainly consulted retailers were older (53, 61 and 68). Three retailers also said

that elderly people come to the store with recommendations from relatives and supplement those recommendations with explanations from sales staff.

4.2. The Acceptability of the EE Label

4.2.1. Whether Consumers Know, Understand, Consider and Trust the EE Label

All three types of interviewees agree that consumers are generally aware of the EE label system for appliances. It is interesting to note that most of them highlighted that people know that the label system exists (i.e., they have seen the labels) but do not fully understand it (Expert 11: *“People know the labels exist, but they do not tell them anything”*).

With respect to the usefulness of the EE label in purchasing decision-making by consumers, four members of the public (out of eleven) said that they did not take the EE label into account when buying a new appliance, but the rest stated that it was useful, especially the colour scale and the EE level letter. However, almost all members of the public interviewed found it hard to understand the energy consumption information in kWh. In the sample group of retailers, there is a discrepancy: half of them stated that consumers used the label but with explanations from the sales staff, while the other half said that customers did not take it into account because they did not understand it, particularly the energy-related information. Most retailers said that consumers generally do not ask them spontaneously for further information and clarifications concerning the EE label because they chiefly look at the EE letter. One of them remarked that now they have to explain the equivalence of the letters in the readjusted EE label to the EE grade in the previous label.

Eleven of the twelve experts agreed that the label is useful for purchasing decision-making by consumers, particularly for the most widely used appliances (fridges, washing machines and dishwashers). However, some highlighted that this is only so when EE is a key criterion in purchasing. Moreover, like the members of the public and the retailers interviewed, all the experts agreed that consumers currently only pay attention to the colour scale, which reminds them of a traffic light, and to the EE level grade (i.e., the letter) (Expert 9: *“When something appears in red everyone associates it with stopping, danger”*). This might be because they do not understand the rest of the information provided on the label. All the experts claimed that consumers did not understand the information on energy consumption, how it was measured (in kWh) or what this meant in financial terms. The experts also stated that people did not understand the more technical information provided by symbols at the bottom of the label (e.g., noise level, water consumption, spin efficiency, etc.). Most argued that this was largely due to the lack of reference levels for comparison.

All three groups of interviewees stated that consumers generally trust the information provided by the label. In fact, all the members of the public asserted in their interviews that they trusted the label, for the reasons summed up as follows: (i) it is a standardised system with the EU symbol which may have undergone official checks; (ii) it is the only visual information that consumers have about EE so they have no choice but to believe it; and (iii) since consumers generally attribute little importance to EE they do not even consider whether it can be manipulated. However, one of the experts highlighted that the level of trust, in general, is decreasing. He mentioned two reasons for this: (i) the Volkswagen emissions case (Expert 11: *“If a company like Volkswagen lies about its emissions, how can we trust what Miele tell us?”*); and (ii) the well-known notion of planned obsolescence (Expert 11: *“Since electrical appliances can be made so as not to work after a certain time, the same could happen with the energy efficiency of appliances”*).

4.2.2. What Consumers Think about the Readjusted EE Label

When asked whether they were familiar with the readjusted EE label for appliances (in use as of March 2021), nine out of eleven members of the public stated that they did not. When they were shown the format of the readjusted label (see Figure 1), some said that they preferred this new scale with EE levels from A to G (Citizen 11: *“I think it is easier to understand now. Before there were too many pluses in the scale”*), others felt that it was now more confusing (Citizen 5: *“If A +++ is now B it seems that you are buying something bad, I*

do not get it, it is confusing"). Most members of the public also declared that the technical information at the bottom of the new label was less clear than on the previous one.

Almost all retailers said that consumers were unfamiliar with the format of the readjusted EE label and that it had caused more confusion among customers (Seller 10: *"The new label is not familiar to them, it is confusing and they do not understand it, we do not even understand it"*; Seller 5: *"If they understood little before, now they understand even less"*). Opinions among the experts regarding the readjusted label are divided. Half of them stated that the new one was better because (i) the readjusted A–G scale distinguishes better between EE levels (Expert 3: *"People hardly noticed differences between the EE levels before: almost all appliances were A+++"*); (ii) the format is clearer, more visual and with less text (it also now has a QR code); and (iii) presenting energy consumption in kWh per 100 uses for washing machines and dishwashers instead of per year fits better with different consumption profiles (Expert 4: *"Consumption per uses makes more sense because not everyone uses the same number of cycles per year"*).

However, the other half of the experts do not prefer the new one because: (i) it entails a different label for each appliance category, as energy consumption in kWh is provided in different units for each type of appliance (Expert 4: *"To some extent, I would try to make the labels for different appliances as similar as possible, otherwise people will get confused. For example, giving the energy consumption over the useful lifetime would enable consumption for all appliances to be standardised"*); (ii) indicating energy consumption in kWh per 100 uses can be difficult for consumers to interpret as it refers to the long term and it is hard to work out how long it will take to reach that number in a home (Expert 5: *"Energy consumption should be per use instead of per 100 uses because consumers are lost in the long term"*); and (iii) the symbols at the bottom of the label are now harder to understand. Table 2 outlines the main positive and negative points about the readjusted label raised by the three types of interviewees.

Table 2. Comparison of the new and old EE labels based on the opinions of the public, retailers and experts.

Positive Aspects	Negative Aspects
+ The A–G scale differentiates better between EE levels	– The technical information at the bottom of the label is less clear
+ Clearer format with less text (includes QR code)	– The A–G scale can be confusing
+ Energy consumption in kWh per 100 uses can be adjusted to different consumption patterns	– Not familiar to consumers (yet)
	– Different labels (energy consumption indicated in different units: per year or per use) for each appliance type
	– Energy consumption per 100 uses is difficult to interpret

Source: Own work based on interview analysis.

4.3. Potential Improvements in the EE Label for Appliances

4.3.1. Potential Improvements in the EE Label

When participants were asked what they thought could be improved in the EE label for appliances, members of the public advocated for greater clarity, especially with regard to the technical symbols at the bottom of the label. Five of the ten sellers wanted the new label to be set out alongside the previous one so that the equivalences of the letters in the two could be clarified (Seller 7: *"If B on the new label is what used to be A+++, this should be indicated"*). Six of the experts proposed the inclusion of monetary information on energy consumption, three asked for greater clarity in the technical symbols (one even proposed

removing them) and the rest said the label was fine as is (Expert 12: *“I doubt there is room for improvement because many people have already put a lot of thought into designing the current one”*).

4.3.2. Whether Consumers Value Having Monetary Information on Energy Consumption, and If So, How They Prefer It to Be Provided

All participants were asked about the possibility of including monetary information about energy consumption on the label. Nine out of the ten members of the public, eight out of the ten retailers, and all twelve experts agreed that such information could be useful and more understandable for consumers. As to whether this monetary information should be presented as costs or savings, the preferences were divided, with 13 of the 29 respondents who found monetary information useful being in favour of presenting it as a cost (five members of the public, one retailer and seven experts), 13 opting for savings (three members of the public, seven retailers and three experts) and one member of the public and two experts advocating for including both.

The arguments behind each choice coincide in all three groups of interviewees: monetary information in terms of savings can be more attractive for consumers (the message is positive) but it requires a benchmark as a reference, so assumptions have to be made. However, cost is not a relative term, and comparisons can be made between the same types of appliances with different consumption levels. This may be less striking than savings for consumers.

We identify three main units in which information on energy costs or savings can be presented: (i) per year or per month; (ii) over the useful lifetime of the appliance; and (iii) per use (for washing machines and dishwashers). There is no clear dominant unit preference among participants. Table A5 in Appendix C shows all the units mentioned in the interviews for costs and savings together with the number of participants who favoured each choice. The most widely mentioned unit in the three groups of interviewees for both cost and savings was per year, followed by a combination of units, and, in particular, information per number of uses for washing machines and dishwashers and per year, per month or over the useful lifetime for fridges.

Arguments for and against all three types of units can be extracted from the analysis (see Table 3). The main arguments for presenting monetary information for a period of time (per year, per month or over the useful lifetime) are that (i) it permits comparison between appliances of all types (Expert 1: *“The cost per year means that different appliances can be compared in the same units, rather than having some appliances measured per use and others per year”*); and (ii) it requires only a simple calculation to work out the amount for more (or fewer) years or months. Although the useful lifetime can be showier for consumers because it reports higher amounts of money, some consumers seem not to believe in it (Retailer 5: *“Today no one believes the indicated useful lifetime of household appliances”*).

The “per number of uses” unit was mentioned particularly for washing machines and dishwashers. The fact that it can take into account different consumption patterns was mentioned as its main advantage (a positive aspect also found in the assessment of the readjusted label). However, three main negative points were made: (i) it requires numerous assumptions regarding programmes, loads, water temperatures, etc.; (ii) the number of uses applied needs to be large for a significant amount of money to be involved (Expert 10: *“Per use calculation results in very small, insignificant amounts for consumers”*); and (iii) it is hard for consumers to calculate how often they will use the appliance in question.

Table 3. Arguments for and against the three types of units according to the interviews with members of the public, retailers and experts.

Per Year or Month		Over the Useful Lifetime		Per Use/s	
Pros	Cons	Pros	Cons	Pros	Cons
+ Possible to compare all types of appliances	– Not very striking (low amount)	+ Possible to compare all types of appliances	– People do not usually believe it	+ Can cover different consumption patterns	– Does not work for appliances that are always on (e.g., fridges)
+ Calculations over the useful lifetime can be obtained		+ Calculations per year can be obtained			– Requires many assumptions, references (load, programme, water temperature, etc.)
		+ Striking (high amount)			– Large numbers of uses are needed to obtain significant amounts
		+ Familiar concept			– Difficult to calculate the number of uses in the future in the home

Source: Own work based on interview analysis.

5. Discussion

Unlike most other studies in the literature, which assess EE labels quantitatively, we seek to provide a qualitative insight into how EE and the label are perceived and understood by consumers, why they are taken into account (and why not) and how the label can be improved. We do this from three different perspectives: those of the public, retailers and experts. This also enables us to draw a comparison between the readjusted EE label for appliances (Directive 2017/1369/EU) and the previous label (Directive 2010/30/EU). To the best of our knowledge, this has not been done before.

Our results are largely consistent with the main findings of the previous literature. Qualitative results show that EE is not a key attribute in purchasing decision-making by consumers for appliances and that EE may be a fuzzy concept for people. The effect of EE as an attribute on consumers' appliance choices seems to be lower than attributes such as price, capacity and brand. This has also been found in other EE-related publications in Spain [16,24,54] and elsewhere [11,27,33,55]. Another important issue is the apparent misunderstanding wherein the concept of EE is confused with energy consumption and savings, as also shown in de Ayala et al. [16] and Waechter et al. [56].

As in other studies, we find that the sociodemographic background of consumers, i.e., income, age, education level, family structure and environmental attitudes, might affect their decisions as to whether to invest in EE. Studies have shown that policy variables (e.g., the EE label, information and education campaigns), attitudinal characteristics (e.g., environmental concerns, energy-saving habits) and economic and demographic variables (e.g., income, age, education, household composition, dwelling type) are significant factors with regard to the adoption of EE [57–60]. According to the experts interviewed, disposable income acts as a budget constraint when purchasing efficient appliances, so policies that deal with potential capital market failures, such as grants and loan facilities, could be useful for promoting EE (see [5,61,62] for a review on EE policies).

The EE label seems to be well-known (i.e., consumers have at least seen it) and regarded as reliable and generally useful by consumers, but the main issue lies in un-

derstanding it in full. Consumers seem to look exclusively at the comparative EE scale via alphabetical letters and colours, which reminds them of traffic lights, an aspect also found in the literature [9,12,16,22,37,56]. However, less attention (or none at all) is given to the information reported on energy consumption and other technical aspects (e.g., noise level, water consumption, spin efficiency) since such information is harder for people to understand. Consumers might not understand energy consumption information in kWh or its implications in monetary terms (e.g., how much they would save during the lifetime of the appliance). Moreover, as pointed out by Waechter et al. [56], information about energy consumption is less prominent than EE information, probably because EE is communicated with an alphabetical, coloured pictogram. Nor do people seem able to follow the symbols at the bottom of the label, as they have no reference points for comparison.

Most consumers seem unfamiliar with the new, readjusted format of the EE label for appliances. However, interviewees, in general, like the updated design and find it cleaner, more visual and less wordy. The return to the original scale format (A–G) on the new label, removing the plus-sign classes, seems to be positively valued in terms of guiding consumers' decisions towards energy-efficient appliances. This is consistent with previous findings in the literature [10–12,37]. However, the number of classes also seems to matter and this remains the same at seven, ranging from A to G. Waechter et al. [10] propose not only dropping the plus signs but removing unnecessary EE categories (those not found on the market) to increase consumers' awareness of the differences in energy friendliness between the classes. D'Adda et al. [22] also emphasise that although energy classes are now expressed as A to G, the way in which they are calculated has not changed. They highlight that EE classes may be an imperfect proxy of energy consumption, so there can be still a significant overlap in energy costs between similar appliances in different EE classes.

Providing energy consumption in kWh per 100 uses for washing machines and dishwashers instead of per year enables different consumption patterns to be taken into account, but it is still awkward to interpret because some people may find it hard to work out how many times they use an appliance at home. Moreover, it requires many assumptions concerning the programme used, the water temperature, etc. Another negative aspect related to the readjusted label identified in our analysis is that having different energy consumption units for different types of appliances (kWh per year for fridges and kWh per number of uses for washing machines and dishwashers) means having a different EE label for each appliance type. Finally, the technical information provided at the bottom of the readjusted EE label seems to still be hard for consumers to interpret, with some saying that it is actually less clear now than before. There are still no reference levels for the different technical aspects presented.

Including monetary information on the energy consumption of the product is a possible improvement for the label that would be positively rated by all our respondents, and one that might help consumers factor energy-related related information into their purchasing decision-making. However, a recent study by d'Adda et al. [22] questions whether providing energy cost information improves consumer welfare: the authors find it to have an insignificant impact on the total costs of purchase and to result in higher product search costs for buyers.

The main challenge of providing monetary information lies in deciding the method of measurement. There is no dominant preference as to the terms (cost, savings) and the unit (per year or month, over the useful lifetime or per use) in which such information should be presented. The positive impact of monetary information on the efficient choices of appliances by consumers has already been quantitatively tested in various studies, in most cases as a cost [19,21,39,40,42] and in a few cases as savings [14,15]. However, the study reported here enables the motivations behind each measurement choice or preference to be identified. Having monetary information in terms of savings seems to be more attractive for consumers, but it requires a reference and therefore assumptions. Energy cost information, however, is not relative (although it also depends on the price of electricity) but it can

be less striking for consumers. The literature includes many more studies that propose monetary information in terms of energy cost than energy savings.

With regard to units of measurement, we identify a slight preference for monetary information (in terms of cost or savings) to be presented per year, as this enables different types of appliances to be compared in the same unit and means that monetary amounts for longer periods of years or even for the whole useful lifetime can be determined. In the literature, the vast majority of studies use lifetime-oriented monetary information. This might be because providing information for a long period may have more impact on purchasing decisions [39,40,63]. However, we find that consumers tend not to trust the reported lifetimes of appliances. The unit per use/number of uses, as currently used on the label to provide energy consumption information for washing machines and dishwashers, appears not to have been quantitatively tested yet in the literature.

It is important to note that efforts to reduce energy consumption in the residential sector should not focus only on improving the EE label to encourage the purchase of high energy-efficiency appliances but also on day-to-day energy-saving behaviours [64,65]. All the experts interviewed agree that to achieve substantial energy reductions and mitigate climate change, policy efforts should be focused on both investment in EE and energy use in the home. Indeed, the literature has shown that investments in EE and user behaviour are not independent and do not necessarily go in the same direction [8,58,62,64].

In addition to the EE label, rebate programmes such as Spain's RENOVE household electrical appliance renewal programme seem to be a useful way of encouraging consumers to make energy-efficient purchases. Indeed, our respondents believe that such programmes have a clear positive impact on the sales of high energy-efficiency appliances. This is consistent with previous studies in Spain [66] and elsewhere [34,67,68].

The role of sales staff and information campaigns on EE also seems also to be crucial, since we find that EE is not the chief factor taken into account by consumers in their appliance purchasing decisions. The positive influence of explanations by retailers on final purchasing decisions by consumers has been observed in the literature [14,18,69]. However, the sales staff interviewed generally require training on EE aspects in order to have an effective impact on their customers' decision-making. Measures focusing on energy use were also seen as necessary and complementary by the experts interviewed, e.g., apps or websites that identify which appliance consumes the most electricity and provide specific advice on how to reduce consumption (see [5,61,62] for a review on EE policies).

6. Conclusions

Increasing EE is a major goal for the coming years. For it to be achieved, households have to purchase energy-efficient appliances. The EU EE label for appliances is key in this, but its effectiveness depends on its acceptability, i.e., the extent to which consumers recognise, perceive and understand the information on the label and take it into account in their purchasing decisions. This paper seeks to contribute to this goal by identifying issues, potential improvements and challenges concerned with the label with a view to nudging consumers towards high energy-efficiency choices. To that end, we have carried out a qualitative analysis based on in-depth interviews with different agents in Spain: members of the public, appliance retailers and academic experts in the field of energy.

Based on our diagnosis of the EE label for appliances, we conclude that it is generally well-known, regarded as reliable and generally useful by consumers. However, most consumers still seem unfamiliar with the readjusted format of the EE label for appliances. In general, the main issue lies in the understanding of the content presented on the label rather than in the design itself. The coloured alphabetical EE scale seems to be liked and well understood. Moreover, the restored A–G scale of the readjusted label seems to be rated positively.

However, we find comprehension issues with regard to (i) the information on energy consumption (both in kWh per year and in kWh per number of uses); and (ii) the technical information, since consumers do not understand the units in which they are measured. To

reduce these information asymmetries, monetary information about energy consumption (though it is not clear whether as a cost or a saving) seems to help consumers understand, but it is technically challenging to provide due to the complexity of the unit of measurement (energy cost or energy savings per month, per year, over the useful lifetime or per number of uses). For technical information, more clarity on what each technical symbol means is recommended, as are reference levels to allow for comparisons. However, this is also technically demanding and requires various assumptions to be made.

Our approach has enabled us to consider the heterogeneity of preferences and experiences and to highlight motivations which would be overlooked in quantitative studies. Nonetheless, it may not be possible to generalise our findings to the whole population, as can be done with quantitative methods. Further research could be supplemented and supported by a quantitative analysis to assess, on a larger scale, some of the issues with the label identified here and some of the policy instruments briefly discussed.

Author Contributions: Conceptualization, A.d.A.; Data curation, A.d.A. and M.d.M.S.; Formal analysis, A.d.A.; Funding acquisition, A.d.A.; Methodology, A.d.A. and M.d.M.S.; Supervision, A.d.A.; Validation, A.d.A.; Writing—original draft, A.d.A. and M.d.M.S.; Writing—review & editing, A.d.A. and M.d.M.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by *Fundación Ramón Areces* under the project entitled “*La toma de decisiones de los hogares en eficiencia energética: determinantes y diseño de políticas*”.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: The authors acknowledge the support of *Fundación Ramon Areces* under XVIII *Concurso Nacional para la Adjudicación de Ayudas a la Investigación en Ciencias Sociales*. This study was conducted as part of the project entitled “*La toma de decisiones de los hogares en eficiencia energética: determinantes y diseño de políticas*”.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Interviewees: Members of the Public, Retailers and Experts

Table A1. Sample of members of the public.

Interviewee	Appliance Purchased	RENOVE Programme	Gender	Age	Education Level	Household Composition	Employment Situation	Household Income Level (€/Month)
1	Fridge (4 years ago)	NO	Female	37	University	Married couple (pregnant)	Unemployed	2500
2	Washing machine (3 years ago) Fridge (3 years ago) Dishwasher (2 years ago)	NO	Female	53	Vocational training	Couple with 3 children	Hotel industry	2000
3	Washing machine (4 years ago)	NO	Female	61	Vocational training	Living alone	Retired	800
4	Washing machine (4 years ago) Dishwasher (2 years ago)	YES	Female	38	University	Married couple with 3 children	Doctor	5000
5	Fridge (1 year ago)	YES	Male	39	University	Married couple with 2 children	Employee	4500
6	Washing machine (1 year ago) Fridge (1 year ago)	NO	Male	24	Vocational training	Living alone (recently emancipated)	Employee	1900
7	Washing machine (3 years ago) Fridge (3 years ago) Dishwasher (2 years ago)	YES	Female	68	Vocational training	Living alone	Retired	700
8	Washing machine (3 years ago) Fridge (4 years ago)	YES	Male	40	Vocational training	Couple with 2 children	Cleaning service	2000
9	Washing machine (<1 year ago) Fridge (3 years ago)	YES	Male	37	University	Living with parents	Self-employed	3600
10	Washing machine (1 year ago) Dishwasher (5 years ago)	NO	Male	56	University	Married couple with 2 children	Financier	N/A
11	Washing machine (<1 year ago) Fridge (<1 year ago) Dishwasher (<1 year ago)	NO	Female	29	University	Couple (recently emancipated)	Administrative	900

Table A2. Sample of retailers.

Interviewee	Type of Establishment
1	Small
2	Medium
3	Small
4	Medium
5	Small
6	Large
7	Large
8	Small
9	Small
10	Medium

Table A3. Sample of experts.

Interviewee	Topic	Position
1	Energy and climate change policies	Senior consultant
2	Energy modelling	Lecturer
3	Energy markets	Lecturer
4	Energy and climate change policies	Senior consultant
5	Energy efficiency	Senior lecturer
6	Energy and climate change policies; energy modelling	Professor
7	Energy efficiency	Senior lecturer
8	Energy modelling	Professor
9	Energy markets	Deputy Director
10	Energy efficiency	Senior consultant
11	Energy modelling; energy efficiency	Professor
12	Energy modelling	Senior researcher

Appendix B. Guideline of the Interviews (Translated into English)

The in-depth interviews used the following general guideline.

Note: At the end of each question or section, the addressees (members of the public, retailers or experts) are specified in brackets.

Appliances:

1. What are the main appliances at your home/in Spanish households/at your retailer? Could you please sort them in order of importance? Why did you choose this order? (Public, Experts, Retailers)
2. Please sort washing machines, dishwashers and fridges into the order of importance for your household/Spanish households/customers? Why did you choose this order? (Public, Experts, Retailers)

Purchasing decision-making

The following questions refer to three main appliances: washing machines, fridges and dishwashers.

1. How long ago (in years) did you last buy a washing machine/fridge/dishwasher for your home? (Public)

2. Who made the decision to buy the new appliance? Did you make it alone or with someone else? With whom? Why? (Public)
3. Why did you not benefit from the *RENOVE* programme when purchasing the new appliance? (Members of the public who did not benefit from the *RENOVE* programme)
4. What attributes did you/consumers/customers consider when buying the new appliance (e.g., price, brand, energy consumption)? (Public, Experts, Retailers)
5. Did you/consumers/customers take the energy efficiency label into account when buying the new appliance? Why? (Public, Experts, Retailers)
6. What is the general energy efficiency level of new appliance/s that you/consumers/customers purchase? High, medium or low? (Public, Experts, Retailers)
7. If you currently want to buy a new appliance for your home, would you consider the same attributes and in the same order as in your last purchase? Or would you change something? What and why? (Public)
8. Would you take the energy efficiency label into account if you currently want to buy a new appliance for your home? Why? (Public)
9. Would you buy a new appliance for your home with a higher or lower energy efficiency level than the previous one? Why? (Public)
10. Do you think the *RENOVE* plan for household appliances influences purchasing decision-making by consumers? If so, how? (Experts)

Energy efficiency and energy consumption

1. What do you/consumers/customers understand by energy efficiency? With what concepts do you/they relate energy efficiency? (Public, Experts, Retailers)
2. What do you think is the general profile of the buyer of a high energy-efficiency appliance? (Experts, Retailers)
3. Do you/consumers monitor the energy consumption of appliances in the home? If so, how (by what methods)? (Public, Experts)
4. What do you think is more effective for promoting energy savings: intervening in the purchase decision and/or intervening in energy use? Why? (Experts)

Energy efficiency label for appliances

1. How do you/consumers/customers obtain energy efficiency-related information on an appliance when buying it? (Public, Experts, Retailers)
2. Are you/consumers/customers familiar with the energy efficiency label for appliances? (Public, Experts, Retailers)
3. Are you/consumers familiar with the readjusted energy efficiency label for appliances in use since March 2021? What do you/consumers think about it (compared to the previous one)? (Public, Retailers)
4. What do you think about the readjusted energy efficiency label for appliances in use from March 2021 (compared to the previous one)? (Experts)
5. Was the EE label helpful in your/consumers'/customers' decision-making concerning the purchase of a washing machine/dishwasher/fridge? Why? (Public, Experts, Retailers)
6. To what do you think consumers mainly pay attention on the energy efficiency label for appliances? Why? (Experts)
7. Do you think consumers understand all the information given on the energy efficiency label for appliances? Why? (Experts)
8. Do customers usually ask you for additional information (or clarifications) regarding any of the concepts or symbols that appear on the energy efficiency label for appliances? Which ones? (Retailers)
9. Do you/consumers/customers trust the information on the label? Why? (Public, Experts, Retailers)

Potential changes

1. Do you think there is room for improvement in the EE label? What? How? Why? (Public, Experts, Retailers)

2. Do you think it would be useful for you/consumers/customers to have visible monetary information on the energy consumption of the appliance (in euros instead of kWh) when buying? Why? (Public, Experts, Retailers)
3. In what form would it be most useful for you/consumers/customers to have this monetary information on the energy consumption of the appliance: as cost (in euros) or as savings (in euros)? Why? (Public, Experts, Retailers)
4. In what unit would it be most useful for you/consumers/customers to have this monetary information (energy cost or savings): per year, per month, per use, over the useful lifetime of the appliance or others? Why? (Public, Experts, Retailers)
5. Do you think there is any other way to inform about the energy consumption and efficiency of appliances apart from the current energy efficiency label (retailers, stands, apps, real-time information, etc.)? Which one would you prefer? Why? (Public, Experts, Retailers)

The role of sales staff (Retailers)

1. Are you up to date on energy efficiency-related issues for household appliances? Are you familiar with the information and technical characteristics of appliances as regards energy efficiency?
2. Do customers ask you for information/explanations about the energy efficiency of the appliance when purchasing? What kind of information do they usually ask you for?
3. What form of providing information on energy efficiency do you think has the most weight in the purchasing decision-making of a new appliance? Why?
4. Does the *RENOVE* plan for appliances have an impact on your establishment's sales? How/in what way? Why?
5. Is the possible impact of the *RENOVE* plan on sales usually felt only while the plan is ongoing or also before and/or afterwards? Why?
6. Does the *RENOVE* plan for household appliances usually affect the stock of household appliances offered at your establishment? How/in what way?

Appendix C. Analysis of Interviews

Table A4. Top three attributes mentioned per product category and group interviewed.

	Washing Machines	Fridges	Dishwashers
Public	1 Technical attributes (ease of use, short duration programmes, rpm) 2 Capacity 3 Ease of use	1 Capacity 2 EE 3 Colour	1 Capacity 2 EE 3 Brand
Retailers	1 Price 2 rpm/Brand 3 EE	1 Dimensions 2 Price/Technical attributes (distribution of drawers and No-frost option) 3 Brand	1 Price 2 Brand 3 Capacity
Experts	1 Price 2 Brand 3 EE	1 Price 2 Brand 3 EE	1 Price 2 Brand 3 EE

Source: Own work based on interview analysis. Notes: (a) The members of the public did not mention the price in their list as they seem to consider it not as an attribute but as a budget constraint. (b) When two attributes are presented in the same rank order (by a /) it is because they were mentioned the same number of times by participants.

Table A5. Units for measuring energy cost and energy savings mentioned by participants in all three types of interviews (public, retailers and experts).

	Cost					Savings				
	Per Year	Per Month	Per Useful Life	Per Uses	Combination	Per Year	Per Month	Per Useful Life	Per Uses	Combination
Public	2	1	1	1	1 (per use/s for washing machines and dishwashers + per month for fridges)	1		2		1 (per use/s for washing machines and dishwashers + per month for fridges)
Retailers					1 (per use/s for washing machines and dishwashers + per useful life for fridges)	3	1	1		1 (per use/s for washing machines and dishwashers + per month for fridges) 1 (per use/s for washing machines and dishwashers + per year for fridges)
Experts	4		1		1 (per use/s for washing machines and dishwashers + per month for fridges) 1 (per useful life + per use for all)	2		1	3	
TOTAL	6	1	2		4	6	1	4	3	3

Source: Own work based on interview analysis.

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